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TELLURIDE MINERALS FROM THE ASHLEY DEPOSIT, BANNOCKBURN TOWNSHIP, ONTARIO

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Abstract

Specimens from the Ashley gold deposit, Bannockburn Township, Ontario contain telluride minerals not previously reported from this locality. These minerals are tellurobismuthite, volynskite, rucklidgeite, calaverite, hessite, tellurite and kuranakhite. This is the first reported occurrence of volynskite and kuranakhite in Canada. An unidentified secondary gold-bearing phase is also present.

Keywords: tellurides, volynskite, rucklidgeite, kuranakhite, Ashley gold deposit, Ontario.

Sommaire

Des échantillons du gisement aurifère d'Ashley (canton de Bannockburn, Ontario) contiennent les minéraux de tellurium suivants non encore signalés à cet endroit: tellurobismutite, volynskite, rucklidgéite, calavérite, hessite, tellurite et kuranakhite. C'est la première trouvaille de volynskite et de kuranakhite au Canada. Un minéral aurifère secondaire reste non-identifié.

(Traduit par la Rédaction)

Mots-clés: tellurides, volynskite, rucklidgéite, kuranakhite, gisement aurifère de Ashley, Ontario.

Introduction

The Ashley property, a former gold producer in Bannockburn Township, Ontario, is located approximately 20 km west-northwest of Matachewan at latitude 48°01′N and longitude 80°54′W, NTS 42A/2W (Fig. 1). The deposit was mined in the 1930s and produced 1,558,996 grams of gold and 237,754 grams of silver from 143,007 tonnes of ore (Gordon *et al.* 1979) According to Rickaby (1932), the orebody consisted of a narrow system of subparallel, interconnected auriferous quartz veins or lenses, referred to collecitvely as the Ashley vein. The vein system is approximately 0.6 m wide, strikes 170° and dips 30 to 50° west. The principal host rocks are tholeiitic basalt flows, in places pillowed, that are intruded by dykes of porphyritic granite and lamprophyre (Fig. 2). In the immediate vicinity of the quartz veins, the basaltic host rocks are altered to an assemblage of quartz, carbonate and pyrite (Rickaby 1932).

Thomson (1932) conducted a mineralographic study of the Ashley vein and identified the following ten metallic minerals: pyrite, galena, native gold, altaite, chalcopyrite, sphalerite, hematite, krennerite, magnetite and pyrrhotite, in decreasing order of relative abundance. This was the first reported occurrence of telluride minerals in the Matachewan area. At present, little evidence remains of the former mining activity. The headframe and other mine buildings have been reduced to their cement foundations, and much of the area is overgrown with trees and bushes. The original Ashley vein, exposed in surface trenches at the time of Rickaby's visit in 1931, is now covered by the waste dump and other surface workings.

The specimens that we studied were taken from a set of subparallel quartz veins east of the Ashley vein (Fig. 2). Where exposed in a short adit at the north end and in surface trenches, this vein system is 1.5 to 2.0 m wide, strikes 170° and dips 45° to the west. Individual veins within the system are 1 to 2 cm wide and are 1 to 10 cm apart (Fig. 3). A thin selvage of K-feldspar, stained red by very fine grained hematite, is commonly present at the margins of the quartz veins, and fine-grained carbonate and pyrite typically replace the basaltic host-rocks adjacent to the veins over widths of approximately 0.5 to 2 cm. Metallic minerals disseminated in the quartz veins, visible in hand specimen, include pyrite, galena, sphalerite, chalcopyrite, native gold and altaite.

Mineralogical Description

Most of the metallic minerals reported by Thomson are present in our specimens; only pyrrhotite and krennerite were not found. The absence of these two minerals appears to distinguish the vein presently exposed at surface from the Ashley vein, although it may be an offshoot.

Altaite PbTe, the most abundant of the tellu-

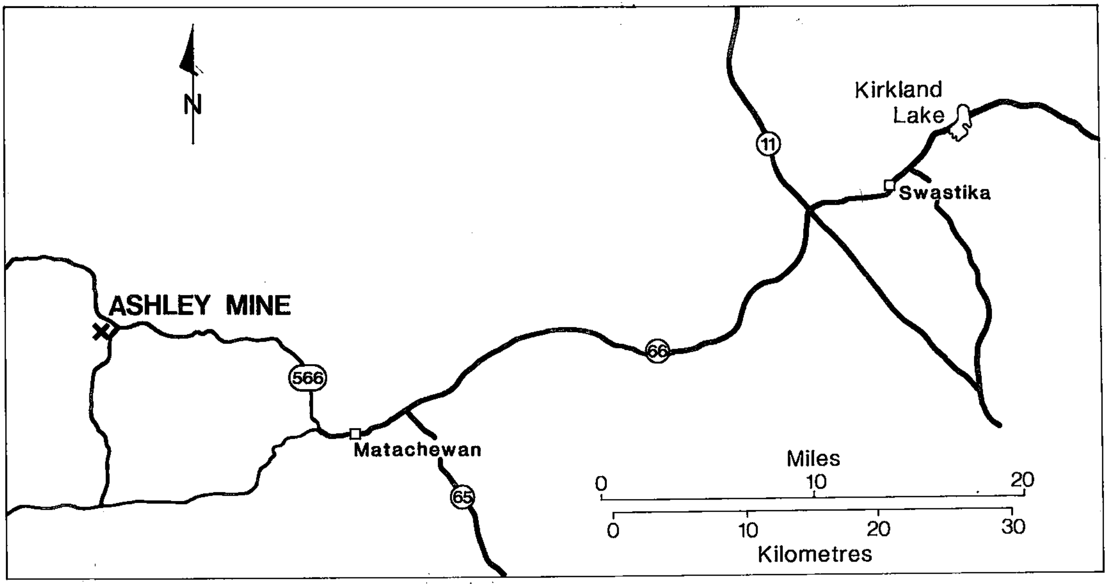

FIG. 1. Location map for the Ashley Mine.

ride minerals, is easily recognizable. In polished section, it is found as anhedral grains typically associated with galena, pyrite and native gold; it commonly contains inclusions of tellurobismuthite, volynskite and rucklidgeite.

Tellurobismuthite Bi_2Te_3, the second most common telluride, forms irregular grains associated with, or as lath-shaped inclusions in, altaite. Most of the inclusions are less than 10×20 µm, with a few up to 70×400 µm. The larger laths contain inclusions of hessite (Fig. 4). Electron-microprobe analysis gave 52.3% Bi and 47.5% Te; total 99.8 wt. % or $Bi_{1.99}Te_{3.00}$. A synthetic bismuth telluride with the composition $Bi_{2.01}Te_3$ was used as a standard.

Volynskite $AgBiTe_2$ is a rare telluride that was first reported as an unnamed silver bismuth telluride by Bezsmertnaya & Soboleva (1963) in gold ores of Armenia. Subsequently, in 1965, the mineral was fully characterized and named by these authors. In the Ashley specimens, volynskite was observed in several polished sections as irregular grains up to 200 µm across associated with tellurobismuthite, rucklidgeite, altaite and galena. It also occurs as small inclusions in rucklidgeite. In reflected light under oil immersion, volynskite is weakly anisotropic, varying from pale pink to grey. Against altaite, it has a slightly purplish tint. It is readily distinguishable from rucklidgeite, which is strongly bireflectant with shades of pink, and strongly anisotropic varying from creamy to pale blue. Electron-microprobe analysis gave 18.0% Ag, 36.6% Bi and 45.2% Te, total 99.8 wt. %, corresponding to $Ag_{1.0}Bi_{1.0}Te_{2.06}$. Synthetic $Bi_{2.01}Te_3$ and pure silver were used as standards. X-ray powder-diffraction data are in close agreement with those reported in the literature, but there are slight discrepancies in estimated intensities. These differences could be due to preferred orientation of the powder mount.

Rucklidgeite $(BiPb)_3Te_4$ was first reported as an unidentified Pb–Bi telluride from the Robb–Montbray deposit, Quebec (Rucklidge 1969). Subsequently, the mineral was reported at two localities in Russia by Zav'yalov & Begizov (1977), who characterized and named the species. Rucklidgeite was identified in several polished sections of samples from the Ashley deposit, particularly those rich in tellurobismuthite and volynskite. The largest grain is 200 µm in diameter; the mineral commonly occurs as intergrowths with volynskite and altaite (Fig. 5). Rarely, it is in contact with native gold, galena and pyrite. Electron-microprobe analysis gave 39.9% Bi, 13.3% Pb, 45.5% Te, total 98.7 wt. %, corresponding to $Pb_{0.72}Bi_{2.15}Te_{4.00}$. Synthetic $Bi_{2.01}Te_3$ and synthetic PbTe were used as standards. The X-ray powder-diffraction data are in agreement with the published values.

Hessite Ag_2Te is rare in the specimens examined. The largest grains (20×30 µm) form inclusions in tellurobismuthite (Fig. 4). Identification was based on a semiquantitative micro-

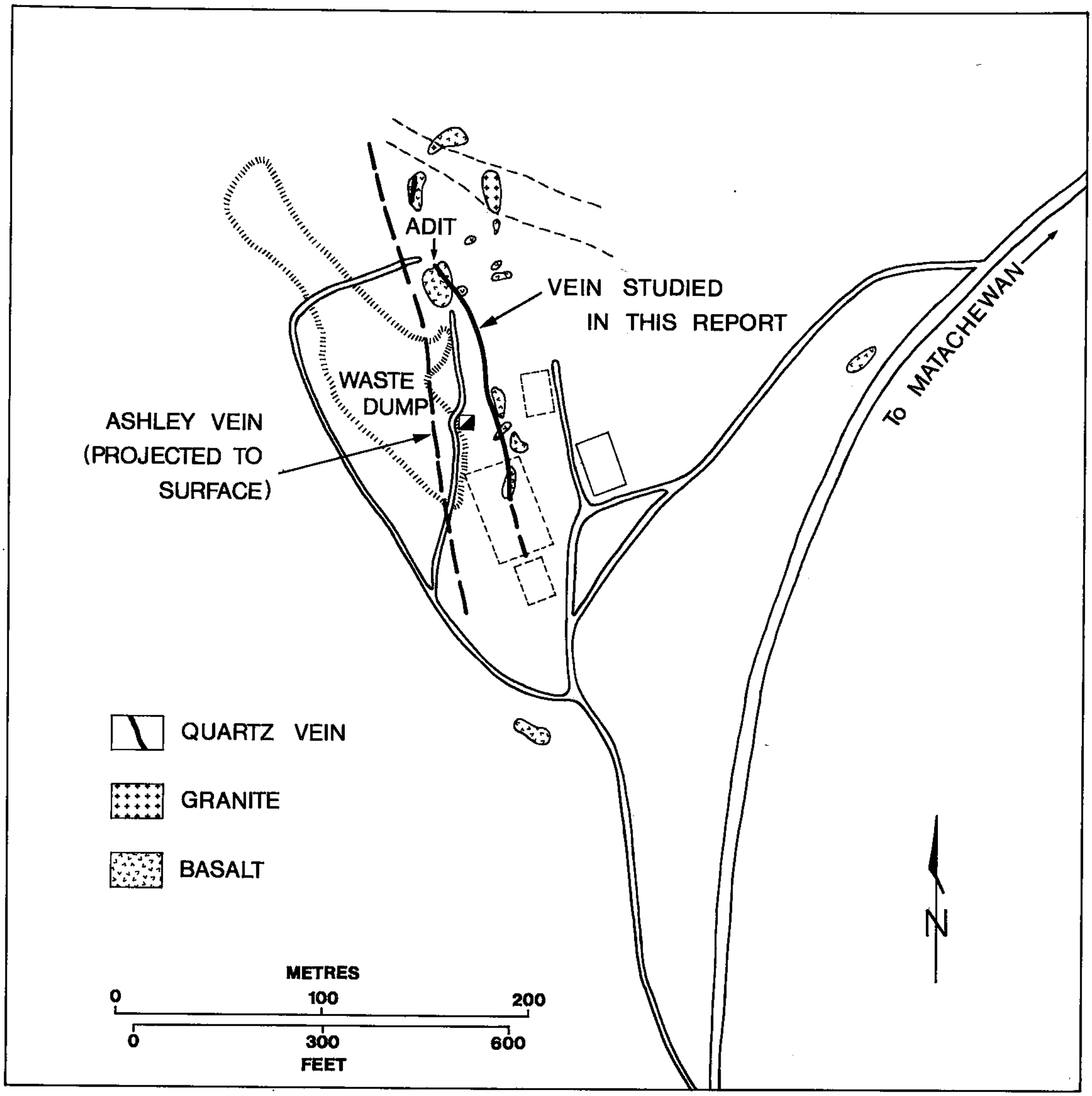

FIG. 2. Sketch map of the Ashley property (based on an unpublished map by W. MacRae, 1980).

probe analysis and on optical properties.

Calaverite $AuTe_2$ is rare, present mainly as isolated grains in the quartz–carbonate vein material. A few grains were observed in contact with altaite. Electron-microprobe analysis gave 44.4% Au, 0.6% Ag, 55.4% Te, total 100.4 wt. % or $Au_{1.04}Ag_{0.03}Te_{2.00}$. The standard used was a synthetic phase with the composition $Au_{0.84}Ag_{0.16}Te_{2.00}$. An X-ray-diffraction study proved the gold telluride to be calaverite.

An *unidentified gold-bearing phase* occurs as a replacement of the calaverite grains, rarely as inclusions in altaite and as isolated grains in quartz–carbonate gangue. It has distinct optical properties, which resemble those of the valleriite-type minerals. Its color is yellowish brown to bronze with areas of red, and it exhibits strong bireflectance and very strong anisotropism varying from brilliant yellow to fiery orange to reddish brown. Many of the grains or rims show rhythmic banding, whereas others have a colloidal-looking texture (Figs. 6, 7). Close examination of this phase with an optical microscope and a scanning electron microscope indi-

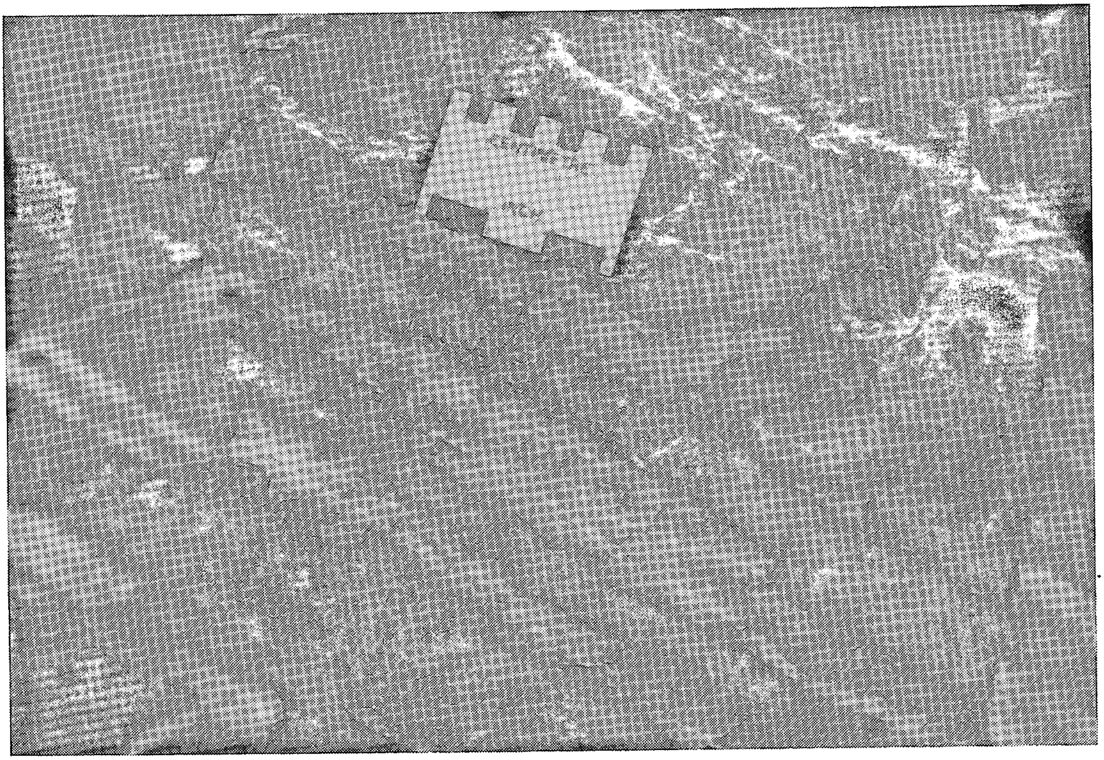

FIG. 3. Subparallel quartz veinlets cutting basalt as exposed in the adit. The quartz veinlets are enclosed by typical carbonate–pyrite alteration envelopes. GSC 203882.

cates that in some places it contains microscopic inclusions of gold, but elsewhere it commonly consists of interlayers of tellurite and kuranakhite. Microprobe analysis of the areas rimming calaverite gave Ag 0.8, Au 48.5, Te 40.7, total 90.0 wt %. Other fragments with no visible associated telluride or oxide minerals gave compositions for three grains of Au 83.5, 87.7, 90.7 and Fe 4.7, 5.1, 0.4, respectively. Other elements with atomic number greater than sodium were not detected. An X-ray powder pattern of these grains is similar to that of native gold. In view of their consistent and unique optical properties, this X-ray result was unexpected and remains inexplicable.

Tellurite TeO_2 forms rims on altaite and is also associated with the unidentified gold-bearing phase. Its identity was confirmed by X-ray powder diffraction.

Kuranakhite $PbMnTeO_6$ is very rare in our specimens and was identified only in a polished section of a heavy-mineral concentrate as interlayers with the unidentified gold phase. Its presence was detected with the scanning electron microscope equipped with an energy-dispersion analyzer, and its identity was confirmed by X-ray powder diffraction. The only other reported occurrence of kuranakhite is in South Yakutia, USSR (Yablokova *et al.* 1975).

DISCUSSION

Gold-bearing quartz veins on the Ashley property near Matachewan have been found to contain numerous telluride minerals, including altaite, calaverite, tellurobismuthite, rucklidgeite, volynskite, hessite and kuranakhite. This is the first reported Canadian locality for volynskite and kuranakhite, and the second for rucklidgeite.

Rucklidgeite and volynskite are Bi- and Te-bearing minerals that occur with tellurobismuthite, altaite and galena in the Ashley veins. They are also associated in other ore deposits. For example, in veins cutting the Lunnon and Juan nickel orebodies, Kambalda, Australia, they occur with palladium-bearing minerals and other tellurides. In the case of the Lunnon Shoot, associated minerals are altaite, galena,

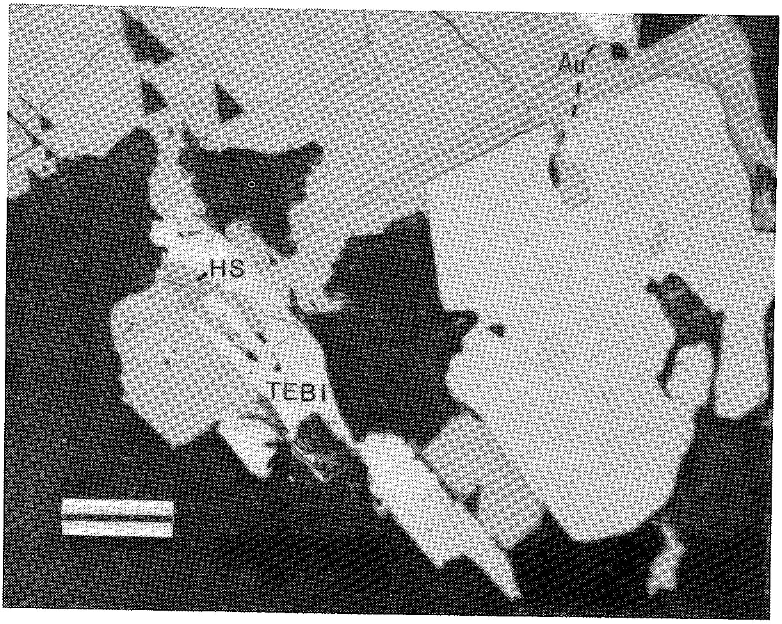

FIG. 4. Photomicrograph of a tellurobismuthite lath (TEBI) containing an inclusion of hessite (HS) in galena. The large idiomorphic grain is pyrite with native gold. Bar scale 100 μm.

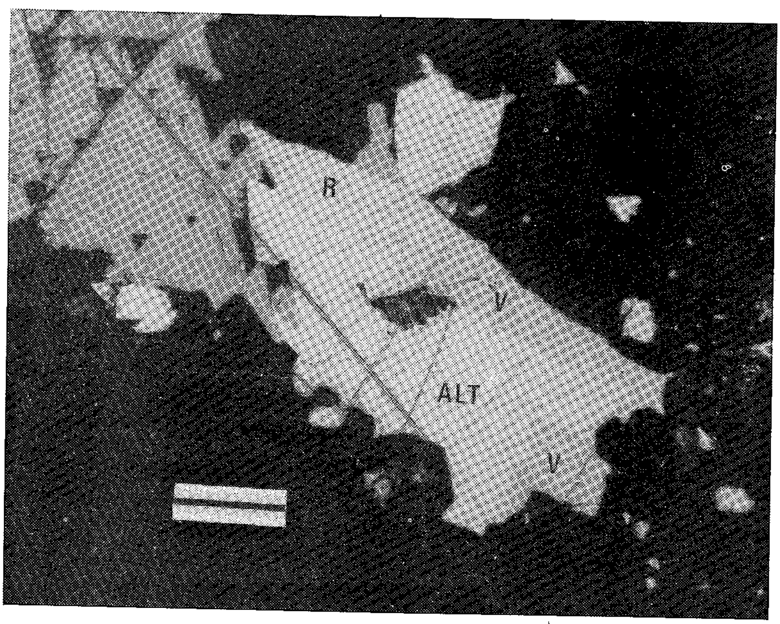

FIG. 5. Photomicrograph of altaite (ALT) containing inclusions of volynskite (V) and rucklidgeite (R). The dark grey mineral with triangular pits is galena. Bar scale 100 μm.

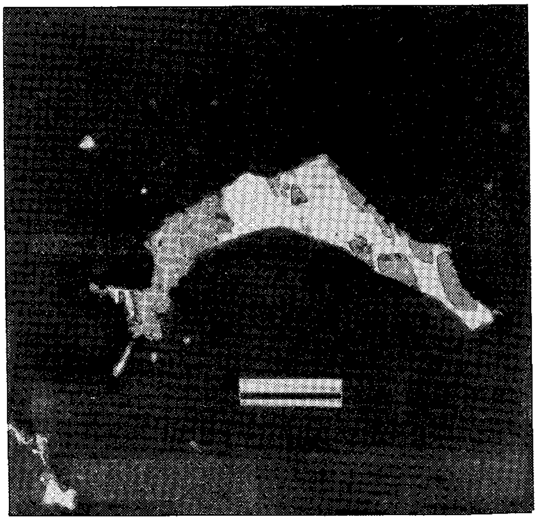

FIG. 6. Photomicrograph of calaverite (white) partly replaced by the unidentified gold phase. Bar scale 100 μm.

hessite, chalcopyrite and trace amounts of gold, michenerite, testibiopalladite, hawleyite (or greenockite) and melonite (Hudson *et al.* 1978). Our work on specimens from the Juan Shoot, kindly supplied by J.J. Gresham of Western Mining Corporation, has revealed relatively abundant altaite, molybdenite, melonite (Pd- and Bi-bearing), pentlandite, pyrrhotite, pyrite and chalcopyrite, and minor volynskite, rucklidgeite, ilmenite, Cd-rich sphalerite, hessite, michenerite and gold. Rucklidgeite and volynskite also occur in gold ore in the Zod deposit, Armenia, USSR (Zav'ylov & Begizov 1977) together with arsenopyrite, pyrite, boulangerite, gersdorffite, galena, freieslebenite, altaite, gold, quartz and dolomite. Tellurobismuthite and tetradymite occur in other specimens from the Zod deposit, but apparently are not associated with rucklidgeite and volynskite.

Rucklidgeite was first reported from the Robb–Montbray gold deposit, Montbray Township, Quebec (Rucklidge 1969). This deposit consists mainly of auriferous chalcopyrite, which forms irregular bodies within the chloritized matrix of a breccia zone in silicified rhyolite (Cooke *et al.* 1931). Rucklidgeite grains, 30 to 40 μm in size, are associated with altaite and are completely surrounded by chalcopyrite (Rucklidge 1969). Other telluride minerals identified from the Robb–Montbray deposit are frohbergite, melonite, tetradymite, tellurobismuthite, krennerite, petzite, coloradoite, montbrayite and calaverite (Thomson 1928, Peacock & Thompson 1946, Thompson 1947, Rucklidge 1969). In contrast, rucklidgeite in the Ashley speci-

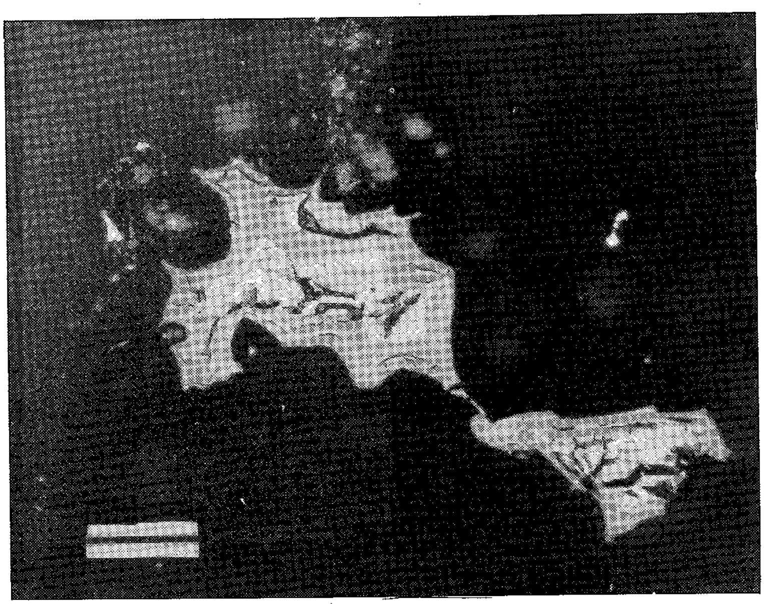

FIG. 7. Photomicrograph of the unidentified gold phase (in quartz–carbonate gangue) showing the optical rhythmic layering. Bar scale 100 μm.

mens forms 200 μm grains intergrown with volynskite and tellurobismuthite.

Volynskite in the Ashley ore occurs as discrete, irregular grains associated with tellurobismuthite, rucklidgeite, altaite and galena, and as small inclusions in rucklidgeite. In the gold ores of Armenia, it forms complex intergrowths with tellurobismuthite where the latter contains hessite and altaite inclusions (Bezsmertnaya & Soboleva 1963).

Kuranakhite in the Ashley specimens is interlayered with a strongly anisotropic unidentified gold phase; these minerals, as well as tellurite, are almost certainly supergene. At the Kuranakh gold deposit, South Yakutia, USSR, kuranakhite occurs in quartz–limonite and quartz–hematite ores of an oxidized zone and is associated with supergene gold, electrum and hydrous iron oxides (Yablokova *et al.* 1975).

In summary, this study of specimens from the Ashley gold property has resulted in the recognition of some rare telluride minerals not reported by previous workers. However, future studies of telluride minerals associated with other gold deposits of the Canadian Shield will undoubtedly demonstrate a wider distribution of some that now appear to be extremely rare.

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